THE PRINCIPLES OF TRAINING

By Medical Inspector H. G. Beyer,
U. S. Navy.

Reprint from

The **MILITARY SURGEON**

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GENTLEMEN: Since 1908 the doors of the War College have been thrown open for the reception and the instruction of naval officers from all branches of the service alike. As the officer representing the Medical Department of the Navy, at the present Conference, and, after some study of the question, I may be permitted to prophecy—and in so doing, I only voice an impression that has already become general—that this liberal departure from the previous policy of the College will, in more than one respect, turn out one of the most significant and portentous moves for the common good of the entire service that has ever been made during its brief, though remarkable history.†

Henceforth, the War College should stand before all officers of

*Delivered at the Naval War College, Newport, R. I., July, 1909. (Lecture I.)

†The promoters of this plan have earned and will continue to earn in an increasing ratio as time goes on, the gratitude of all wellwishers of the service, for manifesting a nobility of purpose, for a serious attempt at subordinating the minor interests of the individual to the higher ones of the service as a whole and utilize and correlate them all to the one all-encompassing end and purpose for which alone our fleet does and ever can exist.

The substance of it all is well expressed and summed up in the few simple but significant words, spoken at a banquet in Washington by Admiral Sperry: "Loyalty to the entire service is better than loyalty to any one of its various branches."

the naval service as a very large and impressive interrogation point behind the simple words: "What can you do for the navy and the fleet?" And, measured by this simple standard of usefulness to the service and its high aims, we all ought to be and must be willing, either to stand and take rank accordingly, or fall and calmly submit to elimination.

THE MEDICAL DEPARTMENT AND THE SERVICE.

Fortunately, the Medical Department of the Navy is in no great danger, even in the face of the most rigid standards of examination, of being eliminated, with regard to its usefulness to the naval service. Its usefulness to the service and the fleet seems, on the contrary, to be on the increase.

Leaving aside all humanitarian aspects of its mission and, considering its purely military bearing on the aims of the service and the objects of the fleet, the Medical Department is connected with them by a thousand threads, tending to make the Navy better during peace and the fleet stronger on the day of conflict.

My brief but rather intimate knowledge and experience at this College this summer, however, has also taught me to circumscribe, with more insight and appreciation than before, its merely relative importance to the whole, as well as to note with a clearer vision the outlines of its limitations. And I have come to believe that it is in the awakening of this consciousness on the part of the officers of the service of the exact relations of the parts to the whole that all constructive and co-operative effort has and practically must have its beginning. Personal responsibility for work well done need not, therefore, be allowed to suffer.

THE FUNCTIONS OF THE MEDICAL AND SANITARY SERVICE IN THE NAVY.

A systematic and discriminating exposition of the exact position and influence of a well organized sanitary service on the navy and the fleet would be a most timely and profitable undertaking at the present juncture. The conviction has grown on me more and more with every day of my attendance at this Conference that the proper relations of the medical and sanitary service to the fleet should become the common knowledge of every officer of the service. It should be made the common knowledge of every officer that there is a sanitary factor, well worthy of the highest consideration, in every war-plan claiming to be complete. (See table.)

NAVAL HYGIENE.

Materiel	*Personnel*
Construction of vessels	Training, moral, mental and physical
Living rooms & Dormitories	Alimentation
Engine and Firerooms	Nutrition
Storerooms and Magazines	Work and Recreation
Kitchen and Bakerooms	Rest and Sleep
Ventilation	Clothing and Bedding
Heating	Climate and Acclimatization
Lighting	Personal Cleanliness
Water-storage	Instruction of Men in Personal Hygiene
Bath and Washrooms	Prophylaxis of Disease
Laundries	Aid & Removal of Wounded.
Cold Storage & Ice Plants	
General Cleanliness.	

This, however, is not the work of a single day nor that of a single man. The short time at my disposal makes it impossible to do more, on this occasion, than to point out a few of the more vital bonds of relationship that exist between the medical and the other departments of the service. And, moreover, these same relations and their relative importance to the whole must change under different conditions.

During the *prevalence of peace,* which is a time of preparation, it is through the various channels of Naval Hygiene that the medical department can exert its greatest and most beneficent influences on the service, as may be seen on the adjoining table. *During war* it will be the preservation of the health and strength of the personnel, to which all possible attention must be paid. *On the day of conflict* all hands must be prepared to throw into the balance all they are and all they possess in strength, health and ability and life itself has only value as used against the enemy. A prompt and safe removal of the sick and wounded is, on the day of conflict, the thing through which the sanitary service can affect the greatest good to a fleet in action.

My remarks will have to be limited to the Hygiene of the Personnel of the service and from among the subjects under this heading I will speak first on *"Training"* and, tomorrow, on *"the care and removal of the sick and wounded."*

No thoughtful observer, no serious-minded student of his profession and its literature, whether belonging to the purely military or other branches of the services, can have failed to note the ever increasing amount of serious attention that is being devoted

to the question of the *Personnel* of the services throughout the world. The most recent literature abounds in treatises devoted to the study of the question of the Personnel of the services, in every one of its various branches.

Thus, with regard to and beginning with the person of the military surgeon, for example, and the characters and attributes that he should possess, Alessandro Pasquale, colonnello medico nella Regia Marina ("Organization of the Sanitary Service and the principles upon which should be based the Aid to the Wounded in Naval Warfare"), Annali di Medicina Navale e Coloniale, vol. II fase V, 1908, p. 601, expresses himself as follows:

"The military physician has not merely the duty of curing, but also and, to a much higher degree, that of preventing. In a military sense it becomes his highest duty to co-ordinate his professional activities harmoniously with all the other military duties of the Navy or Army toward the one supreme end of all the other armaments."

"To still conceive today the military medical man as being simply a skillful surgeon, fitted out with a supply of surgical instruments and accompanied by litter bearers and expert nurses and stretcher-bearers, would mean to ignore the most important portion of the mission which he is called upon to fulfill. Physicians who would exclusively answer to the requisites of a cure may be had under all circumstances. The meritorious red cross and all the other private benevolent aid societies, sprung up solely from humanitarian impulses, would quickly succeed in their efforts at mitigating the *disastrous* consequences of a war. Very different from this is the duty of the military physician, who, already in the performance of his daily professional duties, must never lose sight of the chief object for which the navy and the army exist and incessantly contribute to that great object all his other special attainments, with all the despatch and zeal of which he is capable."

Some of the brightest minds in both services in this as well as in foreign countries have devoted a great deal of their time to the study of the best methods of selection and training of the officers and of the best methods of recruiting and training of the men. In his classification of the functions of a well-organized sanitary service in the navy, Pasquale (loc cit) places "the preparation of strong, healthy and intelligent men" at the head of his list, and Lieutenant Colonel Macpherson* in his recent lecture,

*Macpherson, W. G., Lt. Col., C. M. G., Royal Army Med. Corps, "The Removal of Sick and Wounded from the Battlefield," the Royal Army Med. Corps, Vol. XII, No. 1, Jan., 1909, p. 78.

delivered at the Staff College, Camberly, makes it the first duty of a well organized sanitary service in the army to preserve the health and strength of the troops. Frequent references to the same subject will be found in the "Reports of Military Observers, etc., collected by the General Staff of the U. S. Army. Thus, in Part V, No. 8, of March 7, 1907, Edward McClernand, of the Cavalry, and Wm. V. Judson, Engineers, p. 135, express themselves as follows: "To appreciate an army at its true value it is necessary to study the character of its personnel." Finally, I may be permitted to quote a few lines from Commander T. L. Shelford,* R. N., who says, in his prize essay, very pertinently to our subject: "In every naval war the efficiency of the personnel stands predominant. Without its efficiency no navy is adequate for the purpose of its being. However efficient the strategy may be, however advantageous the position of the fleet for carrying it out, it is dependant for the success on the personnel and the efficiency of the personnel is dependent on training and practice—above all, practice. No naval force, however large, is worth its value unless its personnel are so immured by practice and training as to get the utmost out of it." To all this we can only add our hearty approval. Lastly, the most weighty considerations regarding the personnel of the fleet must, very naturally, gravitate around the person of the Commanding Officer, who represents the source and center of that moral force which must, for either good or ill, animate the whole living machinery of the fleet's personnel.

Inasmuch as the mastery of a vessel, the simple handling of the materiel of a fleet, is but one of the provinces of command, the mastery over men being the other and, in so far as the training that officers receive at this college is intended to add value to their efficiency to take command, meaning to assume responsibility with alacrity, it would seem to be well within the scope of the functions of this College to bestow upon the question of the Personnel of the service a due amount of care and attention.

We may, therefore, say that it is by common consent, by an agreement almost unanimous, that the efficiency of a fleet or of a single ship does not grow exclusively with the growth and the developments of the weapons of offense and defense, but that it, likewise, grows with the strength and with the ability of those who are to handle them against the enemy, and both ability and strength of the personnel develop and grow under the influence

*Shelford, T. L., "The Command of the Sea," of the United Service Institution, June, 1909, Vol. LIII, No. 376, p. 707.

of *proper training*. It is in connection with this important question that the medical officers in the service are in a position to render the most valuable assistance and, wherever they have been taken into the confidence by the general staff of an army or navy, this function of the medical service has become more and more clearly recognized. As one of the latest results of a study of this question in the British service one may note that, for the last two years, all naval surgeons entering the British service have been ordered to the Portsmouth School for Physical Training for a short course of instruction, not so much for the purpose of converting them into physical trainers as with the object in view of stimulating their interest in the subject of training generally, as I understand it, and to cause them to see and realize how and where they, as medical men, may use their knowledge and assist in the *carrying out of the best principles* upon which a proper course of training of any kind must rest.*

For, and although the medical officers in the service will not have the last word to say on the subject, *Training* is essentially and fundamentally a biological process and, as such, subject to well-known biological laws that are absolutely unchangeable. Medical officers in the service are trained in the biological sciences and, therefore, the assumedly best interpreters of the laws of life governing training. And, if today we must deplore the amount of misapprehension that exists on the subject of Training, it is directly and invariably due to a misunderstanding and a misinterpretation of the fundamental laws that govern this process.

What, then, may we ask, is this remarkable process we call training, what does it consist in and what principles does its success rest on?

In the broadest and most general sense, it may be defined as a result of the inherent property of all living matter, of growing and developing, under the influence of the exercise of its special functions, within the range of its capacity.

The human organism, for example, must be looked upon as a compound of many very different and highly specialized tissues and organs, each one of which has a different function to perform. The living organism, in constant communication with the outer world through the channels of its five senses, acts and reacts, in accordance with the changes in its surroundings, and thus it gradually accumulates specific energies—that is, it grows stronger with every new exercise of its peculiar function through the

*Bell, R. D., Surgeon, R. N. "Physical Training and the Medical Profession." Royal Army Medical Corps, June, 1909, p. 639.

various influences it constantly receives from the outside, providing the amount of work it is called upon to do, in doing the exercises, is kept well within the limits of its capacity, and those limits are best summed up in what is known as *fatigue*. In this more general sense brainwork and muscular work rest on the same biological basis.

The eye learns to see, the ear learns to hear, the central nervous system to perceive, interpret and store up impressions, the muscle learns to contract and store up muscular energy, and thus storage batteries, charged with all sorts of specific energies, are distributed throughout the different organs of the body, all connected with and under the co-ordinating influence of an alert and wide-awake central nervous system, dominating them all.

Now, you will all admit, that between a simple visual perception of an external object in our surroundings, such as a house or a tree or a ship, on the one hand, and the reading of a book or interpreting microscopical pictures, or following the courses of the stars through a telescope or sighting a far distant target, on the other, there is a considerable difference. Still more apparent becomes the difference between simple perceptions of external objects, through the special senses of hearing and seeing when *combined* with orderly and purposive muscular contractions, and the remarkable performances of a piano or violin virtuoso bear testimony of that. The distances in time and the differences in the performances of these various functions of the human organism are covered by long years of training—that is, exercises of certain special organs or combinations of organs under the most favorable conditions of growth and with a *definite, specific object in view.*

Under this definition training includes study and practice. The two are in reality one and indivisible, two steps in the same process, imperceptibly merging one into another, meaning work, whether done by braincells or musclecells, or both these combined. All general training, in this sense, is physical, because it means the development of the normal function of a part of our physique to a higher degree of efficiency by exercise.

Work, therefore, as will be seen, in the truest and most general sense of the word, is not done by muscles alone, nor is it the muscles of a man that do the largest amount of it in this world; neither is, in this general sense, the man with the most powerful muscles necessarily also the greatest nor the only kind of an athlete. Man owes his dominant zoological position in the world

of living things to brainwork, and it is through a higher development of brain function that he will continue to advance it.

We have seen not only to what an astounding perfection our own individual latent energies may be developed by proper training, but we, likewise, have seen that the particular training we wish to attain or employ must be determined and governed by a definite and clearly defined object which it is the purpose of our training to accomplish. It is, indeed, always essential to keep in mind the particular energies or combination of energies we wish to develop and store up ready to convert into power, when occasion demands, are specific energies, intended only for a specific object and capable of being developed, consequently, only by special methods. It is also necessary to remember, while in training for any purpose, that our total available energy, although capable of a gradual increase, is limited, and that we must, therefore, concentrate our training upon the specific object before us and not scatter our available energy upon a variety of objects, if the highest perfection in the shortest possible time is expected.

This property or capacity of the living human organism of developing its faculties, through appropriate methods of training, with a definite object in view, to such an astounding perfection is at the bottom of all successful specilization. The physiological law under which it is done and to which it must conform needs no further demonstration. The value of the object must decide whether or no it is worth the price. The law itself remains unchanged, and it is as useless to attempt to get around it or swim against its mighty current as it is to ignore the law of gravity itself.

No one ever learned to handle an oar by swinging dumb-bells. Even as an introductory or preliminary exercise it would only mean a useless waste of time and energy as long as the joints are in a normal condition. If it is through football that you wish to conquer your enemy, it will be by studying football strategy and tactics, on the one hand, and by playing that game, on the other, through which alone you can develop that combination of strength and ability which will enable you to attain your object. If it is the science and art of war that form the objects of your endeavors, it will have to be by playing that game that your training must depend upon and must have its beginning and, before you can possibly be expected to practice, with any possible chance of success, on that more expensive and complicated instrument, a fully manned and equipped fleet at sea and in action.

Neither horseback riding nor playing at lawn-tennis will furnish you that specific endurance which you need for the command of ships at sea. From the point of view of training with a definite object in view both the study of the science of war at this College through map maneuvers and the maneuvers of the fleet at sea are but different halves of the same game, mutually self-regulating and self-correcting parts of a whole, each equally necessary in your training.

But what I, as the exponent of the biological side of this question, consider it as my special duty to impress upon you in this connection and what is of special importance for you to value and realize is the great general principle, namely, that all training, whether called mental, moral or physical, or all three combined, whether for professional, scientific, technical, industrial, military or naval purposes, is indissolubly bound up with the development of faculties resident within the living individual man and a part of his physique, in accordance with physiological principles and laws; that it can be only through the observance of these principles and laws that the highest attainable development of certain faculties, hereditary in the human race, can be expected and that *the object of all training must ever form your most reliable guide in the selection of your methods of training,* and, finally, that you must concentrate your available energies upon your object and not scatter them upon a variety of unrelated objects.

The great importance of the special object in view in all processes of training may, perhaps, with some advantage be illustrated by an example:

Command has been defined by La Bolina* as the "dynamic manifestation of the influence which one man exercises over a group of men in such a manner as to bend them, without the use of violence, to do his own will." We must, consequently, assume that there is, in the art of commanding, an emanation of moral force. This force must, moreover, be strong enough to overcome all possible countercurrents in those who are supposed to receive and execute the orders received. This phsychical force, thus translated into Kinetic energy, is as much subject to an increase in strength by the proper methods of training, in harmony with the laws of biology, as is the strength of our muscles. The methods alone differ. The special object in view—the concentration upon the particular aim by the necessary mental faculties engaged in the process—will not only suggest the most suitable

*La Bolina, Jack. "Riflessioni sul Commando Navale."

methods of training, it must also determine the result in one case as it does in the other.

You will admit that the object in the inventor's mind who constructed the sewing-machine was a different one from that in the mind of him who designed the triple-expansion marine-engine. While the performances of either are wonderful in their way, neither could take the place of the other. Nor can it be said that the knowledge of how to construct the one is a necessary preliminary step in the process of training a man up to construct the other, without considerable deviation from a preconceived purpose and dangerous loss of energy and time. The one needs a good tailor; the other will give up its maximum efficiency only to a highly trained and experienced marine engineer.

So much for the subject of Training and its principles in general. I pass on to the subject of

TRAINING, TERMED PHYSICAL.

The greatest misapprehension exists as regards the training called physical, and one of the greatest mistakes than can be made is to use the term athletic training as if it were but another term for physical training. The distinction between physical training and athletic training must be sharply defined, since the objects aimed at by either are very different.

In physical training the object is to raise the standard of normal health and strength up to their highest level during the developmental or formative stage of life, and all unnecessary strain and fatigue are carefully avoided, while all the normal functions are exercised, within the ever-increasing limits of their nomal capacities, until the highest attainable degree of development is attained.

In athletic training the object before the trainer is to bring the human machine up to its highest point of efficiency, to perform a certain definite feat, and everything interfering with this object, including the machine itself, is sacrificed. During such training the heart is made stronger and larger than necessary for all other vocations of life, if the feat to be performed happens to be one requiring *endurance*. The nervous system is made more alert, if *speed* is one of the factors in the problem. Special muscles are developed at the expense of and the neglect of others and the normal store of fat is lessened, if *agility* is a necessary requirement.

The object is not primarily health, but superlative ability in a definite direction, regardless of health. It is either strength, speed

or endurance, or all three combined, for the accomplishment of a certain object, without regard to the general health of the human body, and certainly the undue absorption of fat leaves the constitution less able to withstand the siege of constitutional infection. This is shown by the increased number of cases of typhoid fever and pneumonia that occur in athletes, either during or immediately after a course of such training, fat, within normal limits, being one of the most valuable assets in resisting disease.

Although, in deciding the value or harmfulness of athletic training, the physiologist may not always have the last word to say; in considerations regarding the service it should never be lost sight of that the athletic class rarely exceeds ten per cent and that it is the main body of the men, and not the athletes at all, that need physical training most and to whom our efforts should be directed, if they are to be made stronger than they are and the general average of the strength of the ship's complement is to be raised! And this is and must remain our chief aim!

"Physical training must not be regarded as an end in itself, but as an essential means toward the equipment of the individual for the work in which he may engage." (Hough.) The athletic ideal is entirely different from that. It does constitute, at the time, an end in itself; its primary aim is not the cultivation of health and strength, but that of excelling some one else. Physical risks must be taken, if necessary—risks which may end in permanent injury, and even in death—in order that one's football team shall prove itself superior to that of some other institution.

The relation of physical training to athletic training is perhaps similar to the relation existing between under-graduate and post-graduate or university instruction, in that the former is simply a means of preparation for the more successful instruction in the latter. And, inasmuch as the course of under-graduate studies selected by the individual is supposed to be the one best adapted to prepare it for the life's work in which it intends to engage, so will the ends of physical training be met, when it prepares a man for his work in which he sees his future life must play a part. (Developmental and Athletic Phys. Tr.)

GENERAL EXERCISES.

There is, however, a third kind of training and which cannot be called either athletic or developmental, educational or preparatory, in the sense in which physical training has been interpreted above. This may best be spoken of as "General Exercise."

"The human frame is constructed for a life of muscular activity" and the "fact that until very recently (*when master mind began to take control of mistress muscle*) mankind has supported itself by physical (*muscular)* rather than by mental exertion must have led to the survival of those with bodies adapted to physical exertion." "So essential was it that this adaptation should be of a very high order that we are not surprised to find that it went to the extent of producing a body not only *capable* of *sustaining,* but even of *profiting* by physical (*muscular*) exertion." (Hough.) (Italics my own.)

It is, then, on this principle of the peculiar constitution of our bodies that we continue to profit throughout life by taking general muscular exercise and even after physical training has done its work of completing all possible normal development and growth of which our bodies were capable. The muscular activity, however, which should continue to form a part of the daily work of our lives, as it formed a part of the lives of our ancestors, although hard and vigorous at times and periods, is *moderate* work. While admitting, as we must, the necessity of taking a moderate amount of daily exercise for the maintenance of general health, it must never be forgotten that our capacities for taking such exercises, as well as our needs of them, like life itself, follow the lines of a binomial curve. The amounts that are necessary, as years go on, have a rise, a prime and a decline. What is merely moderate exercise at twenty may become hard work at forty, and what was moderate exercise at forty may turn out to be a dangerous athletic feat at sixty. For the maintenance of health moderate muscular exercise during every period of life is all that is needed. The training necessary for beating a record, as in football or any other athletic sport, is something distinctly in excess of what is needed. All the so-called *good* effects of exercise experienced during physical training are derived from the *moderate muscular exercises* and not from those that approach the athletic ideal. These are so well known to you that it is unnecessary for me to enumerate them. But it may be well to impress upon you, once more, the fact that these very desirable effects of general moderate muscular exercise on the digestive functions, on sleep, etc., can not be secured *in any other way* than by muscular activity.

FATIGUE.

As was mentioned at the beginning of this lecture, all exercise, whether psychical or muscular, administered with the object of

developing a definite function of the human organism to a higher degree of perfection or efficiency, must absolutely be kept within the bounds of the normal capacity of the individual under training. These bounds or boundaries are formed by a condition known to physiology as *fatigue.*

This interesting biological phenomenon has been the subject of the most profound studies on the part of the best physiologists in the world for many years, but without its yielding up all the secrets of its nature and causation. Without even attempting an analysis of the phenomenon, I shall try to give you just enough of what is known about it as may serve you as a working hypothesis in your efforts at training.

Wherever protoplasm exists in a living organism, there, also, work of some kind is being done, and, on the other hand, wherever work is done, there fatigue is possible.

From the beginning it should always be kept clearly in mind that all extreme exertion of any kind is a debauch, and not an exercise, leaving the individual in a condition of depletion, and that it would have been much better for the health, strength and continued well-being and progress of the individual under training had the debauch never been indulged in.

While it remains true that training in any direction should be made to approach these limits of the normal capacity of the individual, it is safest to avoid transgressing that border-line that separates the normal from the abnormal. This is not only the teaching of sound physiology, but also that of sound, common sense. And, since it is the average man and not the exceptionally gifted who does the world's work, all successful mass training must aim at keeping within the limits of the capacity of the average man, if it is expected that it shall be administered successfully and the object of training shall not be defeated. The exceptionally gifted and more highly endowed man may conform to higher averages. The exceptionally gifted cannot be allowed to set the pace for the average man.

The most recent contribution to our knowledge of fatigue has been made by the German physiologist—Weichardt. Weichardt claims to have found among the products of extreme muscular activity a specific toxin, which is analogous to bacterial toxins, capable of producing the symptoms of fatigue when injected into animals; he likewise produced a specific anti-toxin possessed of striking recuperative powers. "The preparation of his anti-toxin in this country is now protected by patents issued from Washing-

ton, and it is gratifying to feel that if it proved to be the long-sought antidote to fatigue, now commercialised, will come within the provisions of our pure-food laws." (Lee.)

While there must be different causes to different forms of fatigue, one thing seems to be certain, namely, that the cause of muscular fatigue, at least, is, in the main, a toxic substance. Most all of the other energies, outside the purely muscular, are specific energies, and every organ having a special function may, therefore, also be supposed to produce its own specific fatigue substance when worked to excess. But all exact knowledge of this subject is as yet wanting.

We do know that all excessive effort in any direction frequently brings on high temperatures, lasting for days; like the fevers caused by bacterial toxins these are undoubtedly due to the action of fatigue substances.

From this point of view, then, one important element in all training would be the adaptation of the tissues to the toxic fatigue substances. "Without this all the other benefits of training would avail nothing." (Lee.)

Moderate and increasing amounts of exercise, producing moderate but increasing amounts of fatigue substances, would put the tissues, by degrees, into a state of tolerance or resistance, so that, when the supreme effort is demanded, these do not succumb. The whole process of training could, therefore, be explained on the basis of an auto-immunization against fatigue toxins, subject, so far as it can be controlled, to the same biological laws.

That which it is for us, above all else, to remember is that it is fatigue that loses battles, and that it is absence of fatigue that wins victories. It is, consequently, most pertinent to the work of this conference to bestow upon this part of the Hygiene of the Personnel in the Navy its due amount of consideration. The battle of Tsushima was decided in great part by fatigue, on one side, and absence of fatigue, on the other.